

CLAIMS

What is claimed is:

1. Ultrasonic pulser-receiver circuitry, for use with an ultrasonic transducer, the circuitry comprising:
 - a circuit board;
 - ultrasonic pulser circuitry supported by the circuit board and configured to be coupled to an ultrasonic transducer and to cause the ultrasonic transducer to emit an ultrasonic output pulse;
 - receiver circuitry supported by the circuit board, coupled to the pulser circuitry, including protection circuitry configured to protect against the ultrasonic pulse and including amplifier circuitry configured to amplify an echo, received back by the transducer, of the output pulse; and
 - a connector configured to couple the ultrasonic transducer directly to the circuit board, to the pulser circuitry and receiver circuitry, wherein impedance mismatches that would result if the transducer was coupled to the circuit board via a cable can be avoided.
2. Ultrasonic pulser-receiver circuitry in accordance with claim 1 and, when in operation, having a rise time of less than 5 nanoseconds.
3. Ultrasonic pulser-receiver circuitry in accordance with claim 1 and, when in operation, having a rise time of less than 1 nanosecond.

4. Ultrasonic pulser-receiver circuitry in accordance with claim 1 and, when in operation with an ultrasonic transducer, having a front surface ring down of less than 60 nanoseconds.

5. Ultrasonic pulser-receiver circuitry in accordance with claim 1 and, when in operation with an ultrasonic transducer, having a front surface ring down of less than 40 nanoseconds.

6. Ultrasonic pulser-receiver circuitry in accordance with claim 1 and, when in operation with an ultrasonic transducer, having a transducer delay-line of less than 20 microseconds.

7. Ultrasonic pulser-receiver circuitry in accordance with claim 1 wherein no transducer delay-line is required.

8. Ultrasonic pulser-receiver circuitry in accordance with claim 1 and, when in operation with an ultrasonic transducer, having a focal length of about 19 microseconds.

9. Ultrasonic pulser-receiver circuitry in accordance with claim 1 and, when in operation with an ultrasonic transducer, having a depth of field, in time, of less than +/- 32 nanoseconds.

10. Ultrasonic pulser-receiver circuitry in accordance with claim 1 and, when in operation with an ultrasonic transducer, having a depth of field, in time, of less than +/- 2 microseconds.

11. Ultrasonic pulser-receiver circuitry in accordance with claim 1 and, when in operation with an ultrasonic transducer, having a depth of field, in microns, of less than 12.5 μm .

12. Ultrasonic pulser-receiver circuitry in accordance with claim 1 and, when in operation with an ultrasonic transducer, having a depth of field, in microns, of less than 345 μm .

13. Ultrasonic pulser-receiver circuitry in accordance with claim 1 wherein the circuit board has one side supporting at least a majority of the receiver circuitry and an opposite side supporting at least a majority of the pulser circuitry.

14. Ultrasonic pulser-receiver circuitry in accordance with claim 13 wherein at least a majority of the receiver circuitry is defined by components that are surface mounted onto the circuit board.

15. Ultrasonic pulser-receiver circuitry in accordance with claim 13 wherein at least a majority of the pulser circuitry is defined by components that are surface mounted onto the circuit board.

16. Ultrasonic pulser-receiver circuitry, for use with an ultrasonic transducer, the circuitry comprising:

a circuit board;

ultrasonic pulser circuitry supported by the circuit board and configured to be coupled to an ultrasonic transducer and to cause the ultrasonic transducer to emit an

11. Ultrasonic pulser-receiver circuitry in accordance with claim 1 and, when in operation with an ultrasonic transducer, having a depth of field, in millimeters, of less than 12.5 mm.

12. Ultrasonic pulser-receiver circuitry in accordance with claim 1 and, when in operation with an ultrasonic transducer, having a depth of field, in millimeters, of less than 345 mm.

13. Ultrasonic pulser-receiver circuitry in accordance with claim 1 wherein the circuit board has one side supporting at least a majority of the receiver circuitry and an opposite side supporting at least a majority of the pulser circuitry.

14. Ultrasonic pulser-receiver circuitry in accordance with claim 13 wherein at least a majority of the receiver circuitry is defined by components that are surface mounted onto the circuit board.

15. Ultrasonic pulser-receiver circuitry in accordance with claim 13 wherein at least a majority of the pulser circuitry is defined by components that are surface mounted onto the circuit board.

16. Ultrasonic pulser-receiver circuitry, for use with an ultrasonic transducer, the circuitry comprising:

a circuit board;

ultrasonic pulser circuitry supported by the circuit board and configured to be coupled to an ultrasonic transducer and to cause the ultrasonic transducer to emit an

ultrasonic output pulse, the pulser circuitry including an input configured to receive an input pulse from an external source, an input trigger amplifier coupled to the input, a trigger driver coupled to the trigger amplifier, a transistor coupled to the trigger amplifier, and circuitry, including a discharge capacitor and charging and discharging diodes, coupled to the transistor;

receiver circuitry supported by the circuit board, coupled to the pulser circuitry, including protection circuitry configured to protect against the ultrasonic pulse and including amplifier circuitry configured to amplify an echo, received back by the transducer, of the output pulse; and

a connector configured to couple the ultrasonic transducer directly to the circuit board, to the pulser circuitry and receiver circuitry, wherein impedance mismatches that would result if the transducer was coupled to the circuit board via a cable can be avoided.

17. Ultrasonic pulser-receiver circuitry in accordance with claim 16 and, when in operation, having a rise time of less than 5 nanoseconds.

18. Ultrasonic pulser-receiver circuitry in accordance with claim 16 and, when in operation, having a rise time of less than 1 nanosecond.

19. Ultrasonic pulser-receiver circuitry in accordance with claim 16 and, when in operation with an ultrasonic transducer, having a front surface ring down of less than 60 nanoseconds.

20. Ultrasonic pulser-receiver circuitry in accordance with claim 16 and, when in operation with an ultrasonic transducer, having a front surface ring down of less than 40 nanoseconds.

21. Ultrasonic pulser-receiver circuitry in accordance with claim 16 and, when in operation with an ultrasonic transducer, having a transducer delay-line of less than 20 microseconds.

22. Ultrasonic pulser-receiver circuitry in accordance with claim 16 wherein no transducer delay-line is required.

23. Ultrasonic pulser-receiver circuitry in accordance with claim 16 and, when in operation with an ultrasonic transducer, having a focal length of about 19 microseconds.

24. Ultrasonic pulser-receiver circuitry in accordance with claim 16 and, when in operation with an ultrasonic transducer, having a depth of field, in time, of less than +/- 32 nanoseconds.

25. Ultrasonic pulser-receiver circuitry in accordance with claim 16 and, when in operation with an ultrasonic transducer, having a depth of field, in time, of less than +/- 2 microseconds.

26. Ultrasonic pulser-receiver circuitry in accordance with claim 16 and, when in operation with an ultrasonic transducer, having a depth of field, in microns, of less than 12.5 μm .

27. Ultrasonic pulser-receiver circuitry in accordance with claim 16 and, when in operation with an ultrasonic transducer, having a depth of field, in microns, of less than 345 μm .

28. Ultrasonic pulser-receiver circuitry in accordance with claim 16 wherein the circuit board has one side supporting at least a majority of the receiver circuitry and an opposite side supporting at least a majority of the pulser circuitry.

29. Ultrasonic pulser-receiver circuitry in accordance with claim 28 wherein at least a majority of the receiver circuitry is defined by components that are surface mounted onto the circuit board.

30. Ultrasonic pulser-receiver circuitry in accordance with claim 28 wherein at least a majority of the pulser circuitry is defined by components that are surface mounted onto the circuit board.

31. An ultrasonic pulser-receiver comprising:
an ultrasonic transducer;
a circuit board;
ultrasonic pulser circuitry supported by the circuit board and coupled to the ultrasonic transducer to selectively cause the ultrasonic transducer to emit an ultrasonic output pulse, the pulser circuitry including an input configured to receive an input pulse from an external computer, input trigger amplifier circuitry coupled to the input, a trigger driver coupled to the input trigger amplifier means, a high power

transistor coupled to the trigger amplifier, and a discharge capacitor and charging and discharging diodes coupled to the transistor; and

receiver circuitry supported by the circuit board, coupled to the pulser circuitry, including protection circuitry configured to protect against the ultrasonic pulse and including amplifier circuitry configured to amplify an echo, received back by the transducer, of the output pulse, the ultrasonic pulser-receiver, in operation having a rise time of less than 1 nanosecond.

32. An ultrasonic pulser-receiver in accordance with claim 31 and having, in operation, a front surface ring down of less than 60 nanoseconds.

33. An ultrasonic pulser-receiver in accordance with claim 31 and having, in operation, a front surface ring down of less than 40 nanoseconds.

34. An ultrasonic pulser-receiver in accordance with claim 32 and having, in operation, a transducer delay-line of less than 20 microseconds.

35. An ultrasonic pulser-receiver in accordance with claim 33 wherein no transducer delay-line is required.

36. An ultrasonic pulser-receiver in accordance with claim 34 and, in operation, having a focal length of about 19 microseconds.

37. An ultrasonic pulser-receiver in accordance with claim 35 and, in operation, having a depth of field, in time, of less than +/- 32 nanoseconds.

38. An ultrasonic pulser-receiver in accordance with claim 36 and, in operation, having a depth of field, in time, of less than ± 2 microseconds.

39. An ultrasonic pulser-receiver in accordance with claim 37 and, in operation, having a depth of field, in microns, of less than $12.5\ \mu\text{m}$.

40. An ultrasonic pulser-receiver in accordance with claim 38 and, in operation, having a depth of field, in microns, of less than $345\ \mu\text{m}$.

41. An ultrasonic pulser-receiver in accordance with claim 40 wherein the circuit board has one side supporting at least a majority of the receiver circuitry and an opposite side supporting at least a majority of the pulser circuitry.

42. An ultrasonic pulser-receiver in accordance with claim 41 wherein at least a majority of the receiver circuitry is defined by components that are surface mounted onto the circuit board.

43. An ultrasonic pulser-receiver in accordance with claim 42 wherein at least a majority of the pulser circuitry is defined by components that are surface mounted onto the circuit board.